



PLEASE NOTE! THIS IS PARALLEL PUBLISHED VERSION /
SELF-ARCHIVED VERSION OF THE OF THE ORIGINAL ARTICLE

This is an electronic reprint of the original article.
This version *may* differ from the original in pagination and typographic detail.

Author(s): Rantakokko, Merja; Duncan, Rachel; Robinson, Louise; Wilkie, Ross

Title: Natural history of social participation in the very old: Findings from
the Newcastle 85+ study

Year: 2020

Version: final draft

Please cite the original version:

Rantakokko, M., Duncan, R., Robinson, L. & Wilkie, R. (2020). Natural history of social participation in the very old: Findings from the Newcastle 85+ study. *Journal of Aging and Health*, 32 (10), 1552–1561.

URL: <https://doi.org/10.1177/0898264320944672>

Natural history of social participation in the very old: Findings from the Newcastle 85+ study

Merja Rantakokko, PhD¹, Rachel Duncan, PhD², Louise Robinson, MD³, Ross Wilkie, PhD⁴

¹ JAMK University of Applied Sciences, School of Health and Social Studies, Jyväskylä, Finland

² The Newcastle upon Tyne Hospitals NHS Foundation Trust, Freeman Hospital, Freeman Road, High Heaton, Newcastle upon Tyne, NE7 7DN, United Kingdom.

³ Institute of Health and Society, Newcastle University, United Kingdom

⁴ Primary Care Centre Versus Arthritis, School for Primary, Community and Social Care, Keele University, Keele, Staffordshire, United Kingdom, ST5 5BG.

Corresponding author:

Merja Rantakokko

JAMK University of Applied Sciences

School of Health and Social Studies

40400 Jyväskylä, Finland

Merja.rantakokko@jamk.fi

Tel. +358 40 656 0058

Word count: 3975

References: 40

Number of data elements: 5 (Tables 4 and Figures 1)

Running headline: Social participation in the very old

Ethical approval was obtained for all phases of the study from the Newcastle and North Tyneside Local Research and Ethics Committee (Reference 06/Q0905/2)

Natural history of social participation in the very old: findings from the Newcastle
85+ Study

**Natural history of social participation in the very old: findings from the Newcastle 85+
Study**

Abstract

Objective: To describe the natural history of social participation in people aged 85 years and over.

Methods: Prospective cohort study; Newcastle 85+ study. Data were collected at baseline (n=850) and at 18-, 36-, and 60-month follow-ups (n=344). Participation in 19 social activities (e.g. playing bingo, doing volunteer work, watching television) was measured at each time point.

Results: The mean number of activities reported at baseline was 8.7 (SD 2.6). The number of activities was higher in those with higher educational attainment and intact walking ability (both $p<.001$). Social participation decreased significantly over time ($p<.001$) and at a similar rate in both sexes and for those with/without limited walking ability, but at a higher rate in those with higher than lower educational attainment ($p=.019$).

Discussion: Social participation seems to decrease significantly between ages 85 and 90 years; Ways of encouraging social participation in this age group are needed.

Key words (3-5): Participation, social activity, ageing, very old

Natural history of social participation in the very old: findings from the Newcastle 85+ Study

INTRODUCTION

Continuing participation in a wide range of activities, e.g. physical, social, economic, cultural and civic, is a central issue in the World Health Organisation's Active Ageing Policy Framework (World Health Organization, 2002) and Global Strategy and Action Plan on Ageing and Health (World Health Organization, 2017). Participation, defined as involvement in meaningful activities that fulfil aspects of an individual's identity and roles in family and community life, includes engaging in recreational, social and community activities that are important for wellbeing and healthy ageing (Dijkers, 2010; World Health Organization, 2001).

The general concept of participation is an umbrella term which includes social participation. However, whilst social participation is an important concept in aging research, there is no consensus on its definition. Some studies have defined social participation as activities that involve interaction with other people (e.g., Levasseur et al., 2010) while others also include interaction with animals (Carver et al., 2018). Levasseur and colleagues (2010) highlight disciplinary differences in how social participation is defined; for example, in rehabilitation research, social participation is defined with reference to performance and social inclusion, while in aging research it is often considered as social engagement and interaction with other people. Participation and social participation are interchangeable concepts (Piskur et al., 2014).

Levasseur and colleagues (2010) proposed a taxonomy of social activities consisting of six levels of social activities based on an individual's proximity of involvement with others and the goals of the activities. The six levels are: level 1, doing solitary activities such as listening to the radio or watching TV; level 2, being with others but not in direct contact with them, such as walking in the neighbourhood or going to the cinema; level 3, interacting with others without doing a specific activity together with them; level 4, doing an activity with others such as playing a

game; level 5, helping others (volunteering); and level 6, contributing to society, for example through involvement in political parties and organizations. In this study, social participation is defined as the full spectrum of participation in social activities, from levels 1 to 6, representing formal and informal (Levasseur et al., 2015) and collective, productive, and political (Bukov, Maas, & Lampert, 2002) social participation and the fulfilment of social roles (Gignac et al., 2008).

Older people are particularly vulnerable to reduced social participation due to retirement from work, increasing morbidity, and the impact of physical disability and cognitive impairment. Low social participation predicts poorer quality of life (Julien, Gauvin, Richard, Kestens, & Payette, 2013; Thraen-Borowski, Trentham-Dietz, Edwards, Koltyn, & Colbert, 2013; Wilkie et al 2007a), while higher social participation is associated with short- and long-term physical and mental health benefits in older adults (Brown et al., 2016; Douglas, Georgiou, & Westbrook, 2017; James, Boyle, Buchman, & Bennett, 2011). For example, adults aged 60-90 years performed better in memory tests on days when they were socially active (Bielak, Mogle, & Sliwinski, 2019), and adults aged 65 years and over who remain or become socially active are less likely to develop dementia (Foubert-Samier et al., 2014). However, study populations have predominantly consisted of adults younger than 85 years of age, and thus little is known about the frequency of social participation and how it changes in the very old (i.e., adults aged 85 and over).

Low social participation in older people occurs as a result of the complex interaction between individual factors, such as a person's health, and contextual factors, such as their physical, social

and cultural environment (Carver, Beamish, Phillips, Villeneuve, 2018; Goll, Charlesworth, Scior, & Stott, 2015; World Health Organization, 2001). Levels of social participation have been found to differ by sex and levels of educational attainment. Participation has been found to be lower in most forms of social activities in women than men, and lower educational attainment has been associated with a lower level of participation (Finkel, Andel, & Pedersen, 2016; Wilkie et al., 2006, 2007a). Lower levels of social participation have also been linked to physical health and to limited walking ability and transportation barriers (Goll et al., 2015; Szanton et al., 2016; Wilkie et al. 2006), further restricting participation in valued activities (Rosso, Taylor, Tabb, & Michael, 2013).

Adults aged 85 years and over are the fastest growing subgroup in many populations globally. Thus, to inform policy and clinical management strategies to reduce the adverse consequences of ageing on individuals and society, it is important to understand the patterns of social participation in this age group. The aim of this study was to investigate social participation and changes in it over a five-year follow-up in a cohort of adults aged 85 and over participating in the Newcastle 85+ study. We also examined differences in participation by gender, educational level and walking ability.

METHODS

Study design and participants

The Newcastle 85+ study is a longitudinal, observational population-based cohort born in 1921 and permanently registered with a general practice in Newcastle upon Tyne or North Tyneside Primary Care Trusts in the United Kingdom. The recruitment and study protocol have been reported in detail previously (Collerton et al., 2007). Briefly, three methods of data collection were used: (i) a multidimensional health assessment (MDHA), comprising an interview, blood tests, and measurement and function tests, (ii) a general practice record review (GPRR) and (iii) mortality data obtained through NHS Digital.

At baseline, 854 individuals participated in the MDHA. Of these, 850 answered questions on social participation and are included in the present cross-sectional analyses. Follow-up interviews were conducted at 18, 30, and 60 months. The 342 participants with complete data on social participation in all four study phases were included in the longitudinal analyses.

Participant recruitment and retention over the 5-year period are shown in Figure 1. Participant attrition has been reported in detail elsewhere (Davies et al.2014).

Prior to the data collection, an informed written consent was obtained from all participants or, from those who lacked the capacity to consent, from a proxy (Collerton et al., 2007).

Ethical approval for all phases of the study was obtained from the Ethical approval was obtained for all phases of the study from the Newcastle and North Tyneside Local Research and Ethics Committee (Reference 06/Q0905/2)

Insert Figure 1 here

Measurements obtained at MDHA

Social participation

Participants were asked about their frequency of participation in 19 different social activities during the previous four weeks with the following response options: every day, every week, once in the previous four weeks and not at all. These activities were: doing volunteer work; helping other people (not volunteer work); taken care of pets; taken care of plants; listening to the radio; watching television; reading newspapers, magazines or books; spending time on a hobby; walking (or other exercise) for own enjoyment; driving a car for own enjoyment; doing “do-it-yourself” (DIY) activities (such as building, modifying or repairing things) around the house or garden; playing card or board games; playing bingo; talking on the phone to relatives or friends; visiting or being visited by relatives or friends; being in e-mail contact with relatives or friends; taking part in church activities; taking part in club activities; and taking part in cultural activities (i.e. visiting a restaurant, theatre, cinema, art gallery or museum).

The social participation questionnaire evolved from the Time Spending Pattern questionnaire (TSP) used in the Leiden 85+ study on which the Newcastle 85+ study was based. The TSP measures time spent in social and leisure activities (van Eijk, 1997, von Faber et al., 2001, Collerton et al., 2007). The items for the Newcastle 85+ study were selected in collaboration with the Leiden 85+ study team and finalised after pilot testing to determine which questions were relevant for potential participants and measured the construct (indicating acceptable face validity). To reduce responder burden, repeatability was not tested; however, the internal

consistency of the 19-item scale was evaluated for this study and found to be acceptable (Cronbachs'alpha= 0.703).

In the preliminary analysis, factor analysis was used to guide the measurement model and scoring mechanism for the 19 items. However, due to the low correlation between items, the factor analyses resulted in a 7-factor solution with low factor loadings and did not identify meaningful groups (see supplementary file, Appendix 1). Responses to each item were then dichotomised into participating at least once (every day, every week, once in the last 4 weeks) or not participating (not at all). The activities an individual reported participating in were summed, with no assumptions made about the relative importance of individual items (possible score 0-19).

Educational level was measured using a single self-report item on whether the participant had participated in any full-time higher, i.e., college/university, education (yes /no).

Walking ability was measured as the ability to walk 400 yards, using a single item “Are you able to walk at least 400 yards”. Responses were categorized to *not limited* (I have no difficulty doing this by myself) and *limited walking ability* (I have some difficulty doing this by myself; I can only do this by myself if I use an aid or appliance; I am unable to do this by myself; I need someone else's help).

Demographic and descriptive information included *living arrangements* (living alone or living with others) and *housing situation* categorized as independent or assisted living (including

sheltered housing, public sector residential home, private sector residential home, nursing home and long-stay hospital). *Cognition* was assessed with the standardised Mini-Mental State Examination (SMMSE; 0–30 points)(Folstein, Folstein, & McHugh, 1975) and *depression* with the 15-item Geriatric Depression Scale (GDS; 0-15 points)(Yesavage et al., 1982). These were used for descriptive purposes only and thus not included in the analyses.

Statistical analyses

The frequency of social participation in each activity was described in percentages. The number of social activities participated in was normally distributed at all time points (e.g., baseline: skewness -0.102, kurtosis -0.302) and is described as means with standard deviations (SD). At baseline, differences in the frequency of social participation in each activity according to gender, educational level, and walking ability were tested with chi-square tests. Differences in the social participation score were tested with one-way ANOVA.

To examine for attrition bias, sensitivity analyses compared the frequency of social participation at baseline among individuals included in the analysis (n=344) with those who had incomplete data or had dropped out during the 5-year follow-up (n=506) (see supplementary file, Appendix 2).

In the longitudinal setting, analysis of variance for repeated measures was used to examine changes in the number of social activities over time. This was done, first, for the total sample, and then by sex (males vs. females), educational level (full-time higher vs. no higher education) and for walking ability (not limited vs. limited walking). Two participants had missing information in 9 items of social participation in phase 3, and thus sum scores for their social

participation were not calculated and they were excluded from the longitudinal analyses. The final longitudinal sample comprised 342 participants. SPSS version 24.0 (SPSS Inc., Chicago, IL) was used for all the statistical analyses. Results were considered statistically significant when $p < .05$.

RESULTS

Cross-sectional analyses

Characteristics of participants are shown in Table 1. At baseline, 54.6% were living alone, 47.9 % had limited walking ability, 76.4 lived in independent housing, and 11.9 % had received full-time higher education.

The most common types of social participation were watching TV (96.5%), visiting or being visited by relatives and friends (92.5%), reading newspapers, magazines, or books (86.7%), and talking on the phone to relatives or friends (84.9%). The least common were doing voluntary work (5.5%) and being in e-mail contact with relatives or friends (4.2%).

Insert Table 1 here

Amount of social participation stratified by sex

The average number of social activities participated in was 7.7 (SD = 2.9, range 0-15). A small but statistically significant difference in the number of activities was observed between men and women (8.0 (SD 3.0) vs. 7.6 (SD 2.9) ($p=.035$). The proportions of men and women participating in each activity were often significantly different. A significantly higher proportion of men than women participated in walking or other exercise, drove for their own enjoyment, did DIY in their house or garden, and were in email contact with others (all $p\leq.001$). In turn, a significantly higher proportion of women than men went to bingo ($p<.001$), played card or board games ($p=.009$), visited or were visited by relatives or friends ($p=.002$), and took part in church activities ($p=.004$) (Table 2).

Social participation stratified by walking ability

Those with limited ability in walking 400 yards took part in fewer activities than those without walking limitations (6.6 (SD 2.7) vs. 8.9 (SD 2.7) ($p<.001$). This was found for 14 of the 19 activities: doing voluntary work ($p<.001$), helping other people ($p<.001$), taking care of plants ($p<.001$), listening radio ($p<.001$), reading newspapers, magazines or books ($p<.001$), spending time on a hobby ($p<.001$), walking or other exercise for own enjoyment ($p<.001$), driving a car for own enjoyment ($p<.001$), doing DIY around the house or garden ($p<.001$), talking on the phone to relatives and friends ($p<.001$), being in e-mail contact with relatives or friends ($p=.005$), taking part in church activities ($p=.004$), taking part in club activities ($p<.001$), and taking part in cultural activities ($p<.001$) (Table 2). None of the 19 activities were statistically significantly more common among those with limited walking ability (Table 2).

Social participation stratified by educational level

Those with full-time higher education participated in more activities than those without higher education (8.9 (SD 3.2) vs. 7.6 (SD 2.9) ($p < .001$). At the follow-ups, a higher proportion of those with higher education reported listening to the radio ($p = .012$), driving a car for own enjoyment ($p < .001$), playing card or board games ($p = .004$), being in e-mail contact with relatives or friends ($p = .013$), taking part in church activities ($p < .001$), taking part in club activities ($p = .049$), and taking part in cultural activities ($p < .001$) than those who did not. A significantly higher proportion of those without higher education reported watching television ($p = .029$) and visiting friends ($p = .021$) (Table 2).

Insert Table 2 here

Longitudinal analyses

Social participation over time

The number of social participation activities decreased significantly at each subsequent follow-up period ($p < .001$) and especially prior to participant dropout from the study (Table 3). Men and women showed no statistically significant difference in the number of social participation activities over time. Although those with limited walking ability at baseline participated in fewer social activities, they reported a similar decrease in the number of activities over time as those without limited walking ability at baseline ($p = .389$). Those with higher education reported a greater reduction in the number of social activities during the follow-ups than those without

higher education ($p=.009$). This resulted in both groups showing a similar mean number of activities at the 60-month follow-up (7.7 (SD 2.5) vs. 7.3 (SD 3.0)) (Table 4).

Insert Tables 3 and 4 here

DISCUSSION

This study found that while people aged 85-years and over participated in a variety of social activities, these activities decreased over the five year follow up. The number of social activities participated in declined prior to drop-out and was significantly higher among those who survived to age 90 and had complete follow-up data. Older adults with higher educational attainment engaged in more social participation across the five years; however, participation decreased more in this group than in the lower-educated group. Those with limited walking ability participated less than those without mobility difficulties, but by the last follow-up the reduction was similar in both mobility groups. The number of activities reported by men and women at baseline and over time was similar, although the activities reported by men and women were different in nature. This contrasts both with findings in younger populations, where men and women have differed in the number and frequency of social participation, and those of Finkel and colleagues (2016), who reported that after age 70 years, social activity remained stable in women but declined in men.

Men participated more in physically demanding activities, such as walking, physical exercise and doing DIY around the house or garden, while women participated more in less physically demanding but more socially oriented activities (visiting friends, playing bingo, and taking part in church activities). While high social participation levels have been shown to have a beneficial impact on wellbeing in old age, it may be more important to focus on the types of activities that people participate in. Cho et al (2018) found that while many older people spend most of their time participating in “passive activities” such as watching TV and reading, participating in “active activities”, such as joining clubs and organisations and volunteering predicted better life-satisfaction (Cho, Post, & Kim, 2018). Some studies have found that participation in collective activities (e.g. going to the theatre and concerts, artistic hobbies, and acting in organisations) is more protective against mortality and institutionalisation than participation in productive activities (e.g. helping others, doing daily errands, going for a walk) or the overall level of social activities (Nilsen, Agahi, & Shaw, 2018; Pynnonen, Tormakangas, Heikkinen, Rantanen, & Lyyra, 2012).

In addition to the types of activities that people participate in, the place of the activity may be important with respect to the benefits of social participation for health and wellbeing (van den Berg, Kemperman, de Kleijn, & Borgers, 2015). Activities that are performed alone, “passive activities” (Cho et al, 2018), are usually done at home (reading, watching TV, talking on the phone) and were also the most common in our sample of the oldest old people. It is known that with increasing age, people spend most of their time at home or in their neighbourhood areas. This may influence opportunities for social integration and participation, as the home and local

neighbourhood may not provide as many such opportunities as the wider community (Levasseur et al., 2015). This is problematic if people do not have their own transport, especially for older women who do not drive (Viljanen et al., 2016). When the life-space of an older person becomes restricted, it may lead to unmet social participation need (Turcotte et al., 2015), as individuals' desire to participate socially remains, even when they are unable to physically leave their homes (Szanton et al., 2016). This leads to social isolation and poorer quality of life (Rantakokko et al., 2016).

We found that people with limited walking ability and those with a lower level of education participated in fewer social activities. Several domains of life are influenced by socioeconomic status (SES) in old age. In general, people with higher SES are more physically active, in better health, have better cognitive functioning and report better quality of life than people with lower SES (Kingston et al., 2015). Recently, a nationally representative sample in the United States showed that social isolation, assessed with a measure combining living arrangements, network size, religious attendance and social participation (clubs, meetings, group activities and volunteer work), was more common among those with a lower educational level (Cudjoe et al., 2020). Our study, showing that participation was higher among those with a higher educational level, supports this finding. However, we also found that this difference diminished over time. While it is possible that people with a higher educational level may have better financial resources to participate in social activities, other features, such as their health, become more influential in determining their possibilities for participation in very old age.

Our findings confirm previous reports that social participation decreases with increasing age (for review, see Pinto & Neri, 2017) and with increasing health and mobility problems (Bukov et al.,

2002). While we found that, at baseline, people with limited walking ability participated less than those without walking difficulty, we found no differences in the reduction in social participation over time between those with or without limited walking ability. This suggests that issues other than walking and mobility-related problems reduced participation in this age group. Although the lower participation of those with mobility difficulties is not an unexpected finding, we detected no activities, such as light home-based activities such as watching TV, listening to the radio or reading newspapers, magazines, or books, that might be done significantly more by those with limited walking ability than those without walking limitations. It seems that people with mobility problems do not replace activities that they are no longer capable of doing with other less strenuous activities which they may still be able to engage in. Bukov et al (2002) also showed that when people were no longer able to perform demanding activities such as walking, DIY, or joining a club, their participation in less demanding activities also diminished. Nevertheless, this finding suggests that those with limited walking ability are at risk of total exclusion from all activities and social participation, possibly leading to more severe health deterioration.

Our study has its strengths and limitations. The study was a large, population-based cohort drawn from the general population with a high baseline response rate (81.6%). Although loss to follow-up resulting in a 33.0 % response rate occurred over the five-year study period, this was in line with expected levels of attrition in a population of this age. During follow-up, the timing of the data collection enabled the exploration of short- and long-term changes in social participation. The complete case analysis, while it presents observed data, also leads to a reduced sample size and loss of precision. The sensitivity analysis indicated that those who dropped out over time had

more limited walking ability at the baseline and participated less in all social activities than those included in the analysis. Thus, it is possible that our results not only overestimate the number of social activities that our cohort of people over 85 years of age participated in, but also, when we included the full sample (n=344) over the 5-year period, underestimate the decline in social participation, since the full sample analysis excluded the most vulnerable participants. This speculation is supported by the finding of a rapid decline in social participation prior to drop out (Table 2), which may be a sign of deterioration in health and even death. Moreover, the psychometric properties of the instrument used to measure social participation could have been more closely examined, although previous tests have shown good face validity. It should also be noted that cognitive function and depression are other factors that are linked to levels of social participation. However, we were unable to examine the longitudinal relationship over time due to attrition, as those with cognitive impairment and depressive symptoms were much more likely to drop out during follow-up. The association of cognitive decline and depressive symptoms with social participation among the very old is an important topic for future study.

All the variables used in this study were self-reports. While self-report data can be limited by recall bias or misinterpretation of questions, it is an appropriate method of collecting data on social participation and physical functioning. Around half of responders were able to walk 400 yards. Maintaining this level of walking is possible when older adults are mobile in familiar environments. Self-reports reflect walking ability in “real-life” situations (what people do), whereas walking measured in a laboratory reflects individuals’ capacity (what people are capable of doing). It has been shown that capacity-related measures of mobility do not accurately predict

real-life performance (Giannouli, Bock, Mellone & Zijlstra 2016), thereby supporting the use of self-reports of mobility.

Conclusion

The findings of this study indicate that adults aged 85 years and over seem to participate in a variety of social activities and that these decrease in number over time. The social activities engaged in differ by sex, education and physical capacity, and although the frequency of some activities will differ due to choice, interventions using a life-course approach may be necessary to prevent reduced participation due to the accumulation of adverse factors over time. A better understanding of the activities that people participate in will help to support and provide better possibilities for participation. Future studies should include broad measures of social participation to better capture a wide range of different activities and patterns of participation among the very old.

Acknowledgements

We acknowledge the operational support of North of England Commissioning Support Unit and of the local general practitioners and their staff. We thank the research nurses, laboratory technicians, data management and clerical team for outstanding work throughout, as well as many colleagues for their expert advice. Thanks are due especially to the study participants and, where appropriate, their families and carers

Funding

The authors disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was supported by personal grant to MR from Academy of Finland (grant no 285747) and Finnish Ministry of Education and Culture. The Newcastle 85+ study has been funded by the Medical Research Council (G0500997, G0601333, MR/J50001X/1), Biotechnology and Biological Sciences Research Council, the Dunhill Medical Trust (R124/0509) and the National Institute of Health Research School for Primary Care (SPCR 301,356). Parts of the work have also been funded by the British Heart Foundation (PG/08/026/24712), Unilever Corporate Research (CH-2008-1200), Newcastle University,

Newcastle Healthcare Charity (CM/GW 25/9/06) and the North of England Commissioning Support Unit.

Declaration of conflicting interest

The financial sponsors played no role in the design, execution, analysis or interpretation of data, or writing of the study. The authors declare no conflicts of interest.

References

- Bielak, A. A. M., Mogle, J., & Sliwinski, M. J. (2019). What did you do today? Variability in daily activities is related to variability in daily cognitive performance. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences*, 74(5), 764-771. doi: 10.1093/geronb/gbx145.
- Brown, C. L., Robitaille, A., Zelinski, E. M., Dixon, R. A., Hofer, S. M., & Piccinin, A. M. (2016). Cognitive activity mediates the association between social activity and cognitive performance: A longitudinal study. *Psychology and Aging*, 31(8), 831.
- Bukov, A., Maas, I., & Lampert, T. (2002). Social participation in very old age: Cross-sectional and longitudinal findings from BASE. Berlin Aging Study. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences*, 57(6), 510-517.

- Carver L.F., Beamish R., Phillips S.P., Villeneuve M. (2018). A Scoping Review: Social Participation as a Cornerstone of Successful Aging in Place among Rural Older Adults. *Geriatrics (Basel)*, 3(4), 75.
- Cho, D., Post, J., & Kim, S. K. (2018). Comparison of passive and active leisure activities and life satisfaction with aging. *Geriatrics & Gerontology International*, 18(3), 380-386.
- Collerton, J., Barrass, K., Bond, J., Eccles, M., Jagger, C., James, O., . . . Kirkwood, T. (2007). The Newcastle 85 study: Biological, clinical and psychosocial factors associated with healthy ageing: Study protocol. *BMC Geriatrics*, 7(1), 14.
- Cudjoe, T. K., Roth, D. L., Szanton, S. L., Wolff, J. L., Boyd, C. M., & Thorpe, R. J. (2020). The epidemiology of social isolation: National Health & Aging Trends Study. *J Gerontol B Psychol Sci Soc Sci*. 2020;75(1):107-113. doi: 10.1093/geronb/gby037.
- Davies, K., Kingston, A., Robinson, L., Hughes, J., Hunt, J.M., Barker, S.A.H., Edwards, J., Collerton, J., Jagger, C., Kirkwood, T.B.L. (2014). Improving retention of very old participants in longitudinal research: experiences from the Newcastle 85+ study. *PLOS ONE*, 9(10), DOI:10.1371/journal.pone.0108370.
- Dijkers, M. P. (2010). Issues in the conceptualization and measurement of participation: An overview. *Archives of Physical Medicine and Rehabilitation*, 91(9), S16.
- Douglas H., Georgiou A., Westbrook J. (2017). Social participation as an indicator of successful aging: an overview of concepts and their associations with health. *Aust Health Rev*, 41(4):455-462.

van Eijk, L.(1997). Activity and Well-being in the Elderly. Amsterdam, the Netherlands: Thesis Publishers Amsterdam.

von Faber, M., Bootsma-van der Wiel, A., van Exel, E., Gussekloo, J., Lagaay, A.M., van Dongen, E., Knook, D.L., van der Geest, S., & Westendorp, R.G. (2001) Successful aging in the oldest old: Who can be characterized as successfully aged? *Arch Intern Med*, 161(22):2694-2700. doi: 10.1001/archinte.161.22.2694

Finkel, D., Andel, R., & Pedersen, N. L. (2018). Gender differences in longitudinal trajectories of change in physical, social, and cognitive/sedentary leisure activities. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 73(8);1491-1500. doi: 10.1093/geronb/gbw116.

Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research*, 12(3), 189-198. doi:0022-3956(75)90026-6.

Foubert-Samier, A., Le Goff, M., Helmer, C., Peres, K., Orgogozo, J., Barberger-Gateau, P., . . . Dartigues, J. (2014). Change in leisure and social activities and risk of dementia in elderly cohort. *The Journal of Nutrition, Health & Aging*, 18(10), 876-882. doi: 10.1007/s12603-014-0475-7.

Giannouli, E., Bock, O., Mellone, S., & Zijlstra, W. (2016). Mobility in Old Age: Capacity Is Not Performance. *Biomed Research International*, 2016, 3261567). doi.org/10.1155/2016/3261567

- Gignac, M. A., Backman, C. L., Davis, A. M., Lacaille, D., Mattison, C. A., Montie, P., & Badley, E. M. (2008). Understanding social role participation: What matters to people with arthritis? *The Journal of Rheumatology*, *35*(8), 1655-1663. doi:08/13/0625.
- Goll, J. C., Charlesworth, G., Scior, K., & Stott, J. (2015). Barriers to social participation among lonely older adults: The influence of social fears and identity. *PloS One*, *10*(2), e0116664.
- James, B. D., Boyle, P. A., Buchman, A. S., & Bennett, D. A. (2011). Relation of late-life social activity with incident disability among community-dwelling older adults. *Journals of Gerontology Series A: Biomedical Sciences and Medical Sciences*, *66*(4), 467-473. doi: 10.1093/gerona/glq231
- Julien, D., Gauvin, L., Richard, L., Kestens, Y., & Payette, H. (2013). The role of social participation and walking in depression among older adults: Results from the VoisiNuAge Study. *Canadian Journal on Aging = La Revue Canadienne Du Vieillissement*, *32*(1), 1-12. doi:10.1017/S071498081300007X
- Kingston, A., Davies, K., Collerton, J., Robinson, L., Duncan, R., Kirkwood, T. B., & Jagger, C. (2015). The enduring effect of education-socioeconomic differences in disability trajectories from age 85 years in the Newcastle 85 study. *Archives of Gerontology and Geriatrics*, *60*(3), 405-411. doi: 10.1016/j.archger.2015.02.006
- Levasseur, M., Genereux, M., Bruneau, J. F., Vanasse, A., Chabot, E., Beaulac, C., & Bedard, M. M. (2015). Importance of proximity to resources, social support, transportation and neighborhood security for mobility and social participation in older adults: Results from a scoping study. *BMC Public Health*, *15*, 0. doi:10.1186/s12889-015-1824-0

- Levasseur, M., Richard, L., Gauvin, L., Raymond, E. (2010). Inventory and analysis of definitions of social participation found in the aging literature: proposed taxonomy of social activities. *Social Science and Medicine*, 71(12), 2141-9.
- Nilsen, C., Agahi, N., & Shaw, B. A. (2018). Does the association between leisure activities and survival in old age differ by living arrangement? *J Epidemiol Community Health*, 72(1), 1-6. doi: 10.1136/jech-2017-209614.
- Pinto, J. M., & Neri, A. L.(2017).Trajectories of social participation in old age: A systematic literature review. *Rev. Bras. Geriatr. Gerontol.*, 20(2), 259-272.
- Piškur, B., Daniëls, R., Jongmans, M.J., Ketelaar, M., Smeets, R.J., Norton, M., Beurskens, A.J. (2014) Participation and social participation: are they distinct concepts? *Clin Rehabil*, 28(3), 211-20.
- Pynnonen, K., Tormakangas, T., Heikkinen, R. L., Rantanen, T., & Lyyra, T. M. (2012). Does social activity decrease risk for institutionalization and mortality in older people? *The Journals of Gerontology.Series B, Psychological Sciences and Social Sciences*, 67(6), 765-774. doi:10.1093/geronb/gbs076.
- Rantakokko, M., Portegijs, E., Viljanen, A., Iwarsson, S., Kauppinen, M., Rantanen, T. (2016). Changes in life-space mobility and quality of life among community-dwelling older people: A 2-year follow-up study. *Quality of Life Research*, 25, 1189-1197. doi:[10.1007/s11136-015-1137-x](https://doi.org/10.1007/s11136-015-1137-x)

- Rosso, A. L., Taylor, J. A., Tabb, L. P., & Michael, Y. L. (2013). Mobility, disability, and social engagement in older adults. *Journal of Aging and Health, 25*(4), 617-637. doi: 10.1177/0898264313482489.
- Szanton, S. L., Roberts, L., Leff, B., Walker, J. L., Seplaki, C. L., Soones, T., . . . Ornstein, K. A. (2016). Home but still engaged: Participation in social activities among the homebound. *Quality of Life Research, 25*(8), 1913-1920. doi: 10.1007/s11136-016-1245-2.
- Thraen-Borowski, K. M., Trentham-Dietz, A., Edwards, D. F., Koltyn, K. F., & Colbert, L. H. (2013). Dose–response relationships between physical activity, social participation, and health-related quality of life in colorectal cancer survivors. *Journal of Cancer Survivorship, 7*(3), 369-378. doi: 10.1007/s11764-013-0277-7.
- Turcotte, P. L., Lariviere, N., Desrosiers, J., Voyer, P., Champoux, N., Carbonneau, H., . . . Levasseur, M. (2015). Participation needs of older adults having disabilities and receiving home care: Met needs mainly concern daily activities, while unmet needs mostly involve social activities. *BMC Geriatrics, 15*, 1. doi:10.1186/s12877-015-0077-1.
- van den Berg, P., Kemperman, A., de Kleijn, B., & Borgers, A. (2015). Locations that support social activity participation of the aging population. *International Journal of Environmental Research and Public Health, 12*(9), 10432-10449. doi:10.3390/ijerph120910432.
- Viljanen, A., Mikkola, T. M., Rantakokko, M., Portegijs, E., Rantanen, T. (2016). The association between transportation and life-space mobility in community-dwelling older people with or without walking difficulties. *Journal of Aging and Health, 28*(6), 1038-1054. doi:[10.1177/0898264315618919](https://doi.org/10.1177/0898264315618919)

Wilkie, R., Peat, G., Thomas, E., Croft, P. (2006). The prevalence of person-perceived participation restriction in community-dwelling older adults. *Quality of Life Research : An International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation*, 15(9), 1471-1479. doi:[10.1007/s11136-006-0017-9](https://doi.org/10.1007/s11136-006-0017-9)

Wilkie, R., Peat, G., Thomas, E., Croft, P. (2007a). Factors associated with participation restriction in community-dwelling adults aged 50 years and over. *Quality of Life Research : An International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation*, 16(7), 1147-1156. doi:[10.1007/s11136-007-9221-5](https://doi.org/10.1007/s11136-007-9221-5)

Wilkie, R., Peat, G., Thomas, E., Croft, P. (2007b). Factors associated with restricted mobility outside the home in community-dwelling adults ages fifty years and older with knee pain: An example of use of the international classification of functioning to investigate participation restriction. *Arthritis and Rheumatism*, 57(8), 1381-1389. doi:[10.1002/art.23083](https://doi.org/10.1002/art.23083)

World Health Organization (2001). *International classification of functioning, disability and health: ICF*. Geneva: World Health Organization.

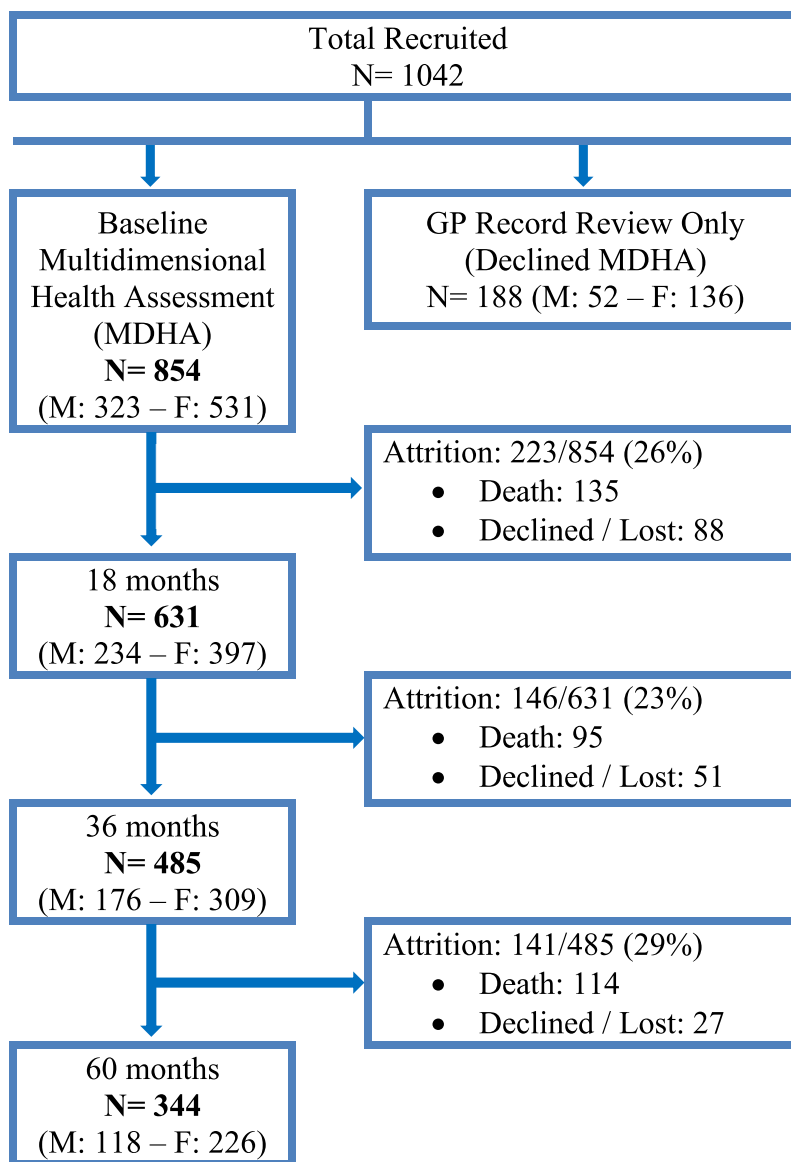
World Health Organization (2002). *Active ageing: A policy framework*. Retrieved from http://whqlibdoc.who.int/hq/2002/WHO_NMH_NPH_02.8.pdf?ua=1

World Health Organization (2017). *Global strategy and action plan on ageing and health*. Retrieved from <https://www.who.int/ageing/WHO-GSAP-2017.pdf?ua=1>

Yesavage, J. A., Brink, T. L., Rose, T. L., Lum, O., Huang, V., Adey, M., & Leirer, V. O.

(1982). Development and validation of a geriatric depression screening scale: A preliminary report. *Journal of Psychiatric Research*, 17(1), 37-49.

Figure 1. Flowchart of participants in the Newcastle 85+ study: baseline to 5-year follow up.



Note: GP, General Practitioner

Table 1. Baseline characteristics of 85-year-old participants included in the cross-sectional (n=850) and longitudinal (n=344) analyses.

	Cross-sectional n=850	Longitudinal sample n=344
	% (n)	% (n)
Gender		
Women	62.0 (527)	65.7 (226)
Men	38.0 (323)	34.3 (118)
Living arrangement		
Living alone	54.6 (464)	58.4 (201)
Living with others	34.9 (297)	38.4 (132)
Did not provide information	10.5 (89)	3.2 (11)
Housing type		
Independent	76.4 (649)	84.6 (291)
Assisted	23.6 (201)	15.4 (53)
Walking		
Limited ability	47.9 (407)	66.6 (229)
Not limited ability	51.9 (441)	33.4 (115)
Educational level		
Any full-time higher education	11.9 (100)	14.5 (50)
No full-time higher education	88.1 (743)	85.8 (294)
	Mean (s.d.)	Mean (s.d.)
Depression, GDS Score	3.57 (2.6)*	3.09 (2.5)
Cognition, MMSE	25.8 (5.5)	27.2 (3.6)
* n=771		

GDS = Geriatric Depression Score, MMSE = Mini Mental State Examination, SD = standard deviation

Table 2. Distribution of participation at least once a month in social activities at baseline, by sex, educational level, and walking ability among 85-year-old people (n=850).

	Women n=527	Men n=323	<i>P</i> †	Higher education n=100	No higher education n=743	<i>P</i> †	Walking ability limited n=407	Walking ability not limited n=441	<i>P</i> †
	%	%		%	%		%	%	
Have you...									
done voluntary work	6.5	4.0	.133	9	5.1	.112	2.0	8.8	<.001
helped other people (not voluntary work)	11.6	17.0	.025	15	13.6	.701	7.2	19.8	<.001
taken care of pets	8.7	9.3	.781	11	8.7	.460	8.2	9.8	.416
taken care of plants	50.5	50.8	.932	59	49.8	.084	39.9	60.9	<.001
listened to the radio	63.8	72.1	.012	78	65.4	.012	59.8	74.5	<.001
watched television	96.0	97.2	.358	93	97.2	.029	96.1	97.3	.321
read newspapers, magazines or books	86.1	87.6	.541	90	86.7	.352	81.2	92.3	<.001
spent time on a hobby	48.2	52.9	.179	56	49.5	.224	39.0	60.9	<.001
walked (or other exercise) for own enjoyment	41.9	54.2	.001	53	46.2	.198	26.2	65.9	<.001
driven a car for your own enjoyment	5.3	27.2	<.001	35	10.9	<.001	6.5	20.5	<.001
done DIY around the house or garden	14.4	36.5	<.001	27	22.5	.313	9.7	35.1	<.001

played card or board games	21.1	13.9	.009	29	17.1	.004	16.8	20.0	.236
played bingo	27.7	13.6	<.001	15	23.6	.055	23.8	21.4	.394
talked on the phone to relatives or friends	86.3	82.7	.146	91	84.7	.092	78.8	91.2	<.001
visited/been visited by relatives or friends	94.7	88.7	.002	87	93.4	.021	93.1	92.3	.650
been in e-mail contact with relatives or friends	2.1	7.7	<.001	9	3.6	.013	2.2	6.2	.005
taken part in church activities	25.6	17.0	.004	40	20.2	<.001	18.3	26.5	.004
taken part in club activities	25.8	27.9	.510	35	25.7	.049	19.3	33.7	<.001
taken part in cultural activities	41.4	40.9	.886	59	39.0	<.001	30.3	51.7	<.001
	Mean (sd)	Mean (sd)	P*	Mean (sd)	Mean (sd)	P*	Mean (sd)	Mean (sd)	P*
Sum score of social participation	7.6 (2.9)	8.0 (3.0)	.035	8.9 (3.2)	7.6 (2.9)	<.001	6.6 (2.7)	8.9 (2.7)	<.001
<p>‡ <i>Chi-square test</i> * <i>One-way ANOVA</i> DIY, do-it-yourself</p>									

Table 3. Frequency of participation at least once a month in social activities across 60 months among 85-year-old people at baseline (n=342).

	Baseline		18 months		36 months		60 months		
	%	(n)	%	(n)	%	(n)	%	(n)	
Volunteering	8.7	(30)	7.8	(27)	5.3	(18)	4.7	(16)	
Helping	17.8	(61)	17.2	(59)	17.8	(61)	9.9	(34)	
Taking care of pets	10.5	(36)	7.3	(25)	5.3	(18)	4.4	(15)	
Taking care of plants	60.8	(209)	57.8	(199)	50.9	(174)	47.7	(164)	
Listening Radio	71.7	(246)	68.3	(235)	63.6	(218)	58.7	(202)	
watching TV	97.4	(335)	96.8	(333)	95.9	(329)	94.8	(326)	
Reading Newspapers	92.7	(319)	90.7	(312)	88.3	(303)	82.6	(284)	
Spent time on Hobby	59.8	(205)	53.2	(183)	53.5	(183)	56.1	(193)	
Walking or other exercise	59.5	(204)	50.3	(173)	39.2	(134)	34.6	(119)	
Driving	17.8	(61)	14.8	(51)	9.6	(33)	8.1	(28)	
Doing DIY	30.3	(104)	21.9	(75)	19.9	(68)	16.3	(56)	
Playing card, board games	19.2	(66)	21.6	(74)	15.5	(53)	20.4	(70)	
Playing bingo	22.4	(77)	19.9	(68)	17.5	(60)	19.8	(68)	
Talking on the phone to relative or friend	93.0	(320)	93.0	(320)	86.6	(297)	82.0	(282)	
Visiting or being visited by friends/relatives	94.8	(326)	95.3	(328)	95.3	(327)	95.6	(329)	
Being in email contact	5.9	(20)	4.4	(15)	3.8	(13)	3.8	(13)	
Take part in church activities	26.5	(90)	26.1	(89)	24.0	(82)	22.1	(76)	
Take part in club activities	35.2	(120)	33.2	(113)	25.2	(86)	22.7	(78)	
Take part in cultural activities	47.5	(163)	55.8	(191)	53.4	(182)	55.7	(191)	
	Mean	(sd)	Mean	sd	Mean	sd	Mean	sd	P
Sum score of social participation (n=342)	8.7	(2.6)	8.4	(2.7)	7.7	(2.7)	7.4	(2.9)	<.001
Losses at 18mo (n=220)	6.4	(3.1)	-	-	-	-	-	-	
Losses at 36mo (n=144)	7.5	(2.8)	6.6	(2.7)	-	-	-	-	
Losses at 60mo (n=140)	7.7	(2.8)	7.5	(3.0)	6.5	(2.8)	-	-	
SD = standard deviation									
DIY = do-it-yourself activities									

Table 4. Number of social activities participated in by 85-year-old adults (n=342) at baseline and at 18, 36, and 60 months; mean (SD)								
		Baseline	18 mo	36 mo	60 mo	Time*	Group	Group x time*
		Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)		P	P
Walking ability						<.001	<.001	.389
	Not limited	9.1 (2.6)	8.9 (2.7)	8.3 (2.7)	7.9 (2.9)			
	Limited	7.8 (2.4)	7.1 (2.3)	6.6 (2.2)	6.4 (2.6)			
Gender						<.001	.092	.577
	Men	9.0 (2.5)	8.7 (2.9)	8.0 (2.7)	7.5 (3.2)			
	Women	8.5 (2.6)	8.1 (2.6)	7.5 (2.6)	7.3 (2.8)			
Educational level								
	Higher education	9.6 (2.9)	9.6 (2.6)	8.5 (2.7)	7.7 (2.5)	<.001	.006	.019
	No higher education	8.6 (2.5)	8.1 (2.7)	7.6 (2.6)	7.3 (3.0)			
* Greenhouse-Geisser test SD = standard deviation								

SUPPLEMENTARY MATERIAL

Appendix 1. Factor analyses on social participation at baseline among people of 85 years (n=850)

how often have you..	Factor						
	1	2	3	4	5	6	7
done any voluntary work	.103	.021	.079	.456	-.033	-.009	.061
helped other people (not voluntary work)	.170	-.006	-.002	.492	.135	.105	-.090
taken care of pets	.021	-.019	-.053	-.017	.004	-.007	.291
taken care of plants	.487	.179	.032	.159	-.070	.134	.470
listened to the radio	.139	.164	.042	.109	.171	-.046	.245
watched television	.067	.469	.067	-.030	.049	.155	-.033
read newspapers, magazines or books	.110	.700	.006	.062	.062	.022	.074
spent time on a hobby	.359	.266	.121	.077	.126	.065	.262
walked (or other exercise) for own enjoyment	.308	.120	.187	.224	.188	.147	.091
driven a car for your own enjoyment	.185	.066	-.041	.172	.529	-.004	.035
done any DIY around the house or garden	.669	.078	-.003	.063	.244	.015	.031
played card or board games	.006	.025	.289	.137	.101	-.029	-.002
played bingo	-.006	.037	.666	-.044	-.189	.075	-.191
talked on the phone to relatives or friends	.064	.396	.086	.090	.072	.539	.242
visited/been visited by relatives or friends	.048	.057	.020	.030	-.074	.514	-.060
been in e-mail contact with relatives or friends	.045	.022	.051	-.016	.324	-.051	-.007
taken part in church activities	-.065	.023	.138	.384	.081	.011	.063
taken part in club activities	.117	.058	.489	.176	.161	.072	.094
taken part in cultural activities	.041	.106	.126	.197	.316	.171	.228

Extraction Method: Principal Axis Factoring.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 7 iterations.

Appendix 2. Comparison of frequency of social participation at baseline among those participating in follow-up and those who drop-out during the follow-up in people of 85 years (n=850).

Have you...	Non-Participants n=506		Participants n=342-344		P†
	%	(n)	%	(n)	
done any voluntary work	3.4	(17)	8.7	(30)	.001
helped other people (not voluntary work)	10.9	(55)	17.8	(61)	.004
taken care of pets	7.9	(40)	10.5	(36)	.196
taken care of plants	43.8	(221)	60.8	(209)	<.001
listened to the radio	64.2	(323)	71.7	(246)	.022
watched television	96.0	(485)	97.4	(335)	.290
read newspapers, magazines or books	82.9	(418)	92.7	(319)	<.001
spent time on a hobby	43.8	(220)	59.8	(205)	<.001
walked (or other exercise) for own enjoyment	38.2	(192)	59.5	(204)	<.001
driven a car for your own enjoyment	10.9	(55)	17.8	(61)	.004
done any DIY around the house or garden	17.9	(90)	30.3	(104)	<.001
played card or board games	17.9	(90)	19.2	(66)	.619
played bingo	22.5	(113)	22.4	(77)	.983
talking on the phone to relatives or friends	79.5	(402)	93.0	(320)	<.001
visited/been visited by relatives or friends	91.1	(460)	94.8	(326)	.045
been in e-mail contact with relatives or friends	3.2	(16)	5.9	(20)	.057
taken part in church activities	19.8	(100)	26.5	(90)	.022
taken part in club activities	21.0	(106)	35.2	(120)	<.001
taken part in cultural activities	37.2	(187)	47.5	(163)	.003
	Mean	sd	Mean	sd	P*
Sumscore of social participation	7.2	3.0	8.7	2.6	<.001

‡ <i>Chi Square test</i>						
* <i>One-way ANOVA</i>						
<i>DIY, do-it-yourself</i>						